8th. World Congress on Computational Mechanics (WCCM8)
5th. European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2008)
June 30 – July 5, 2008
Venice, Italy

The Two-order and Two-scale Method in Cylindrical Coordinates for Mechanical Properties of Laminated Composite Cylindrical Structure

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Key Words: *Laminated Cylinder, Mechanical Properties, Multiscale Modeling, Finite Elements Analysis, Two-order and Two-scale method.*

ABSTRACT

The two-order and two-scale method is firstly presented in cylindrical coordinates by virtue of that material has periodicity in radial direction in laminated composite cylindrical structure. This method is established for predicting the mechanical properties of this kind of cylindrical structure, including stiffness parameters, strains, stresses and elastic limit load. First the geometry model and the elasticity equations are described. Then the two-order and two-scale analysis formulation in cylindrical coordinates is developed by means of material periodicity in radial direction. And for the hollow cylinders subject to equal pressures and linearly varying pressures in axial direction respectively, the two-order and two-scale expressions of the stains and stresses are developed based on the fundamental solutions, and then the procedure of the computation is discussed in detail. Finally, the numerical results for the above conventionally mechanical examples are compared with the results calculated by the software ANSYS. The agreements indicate that the two-order and two-scale method is effective and credible to predict the mechanical properties of laminated composite cylindrical structure. And some conclusions are also obtained by analyzing the numerical results, which are significant to design the composite pressure cylindrical structures. Moreover, the more the composite layers are, the more efficient the two-order and two-scale method is.

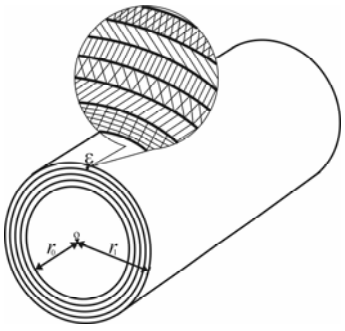

Figure: geometric model of laminated composite cylindrical structure

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